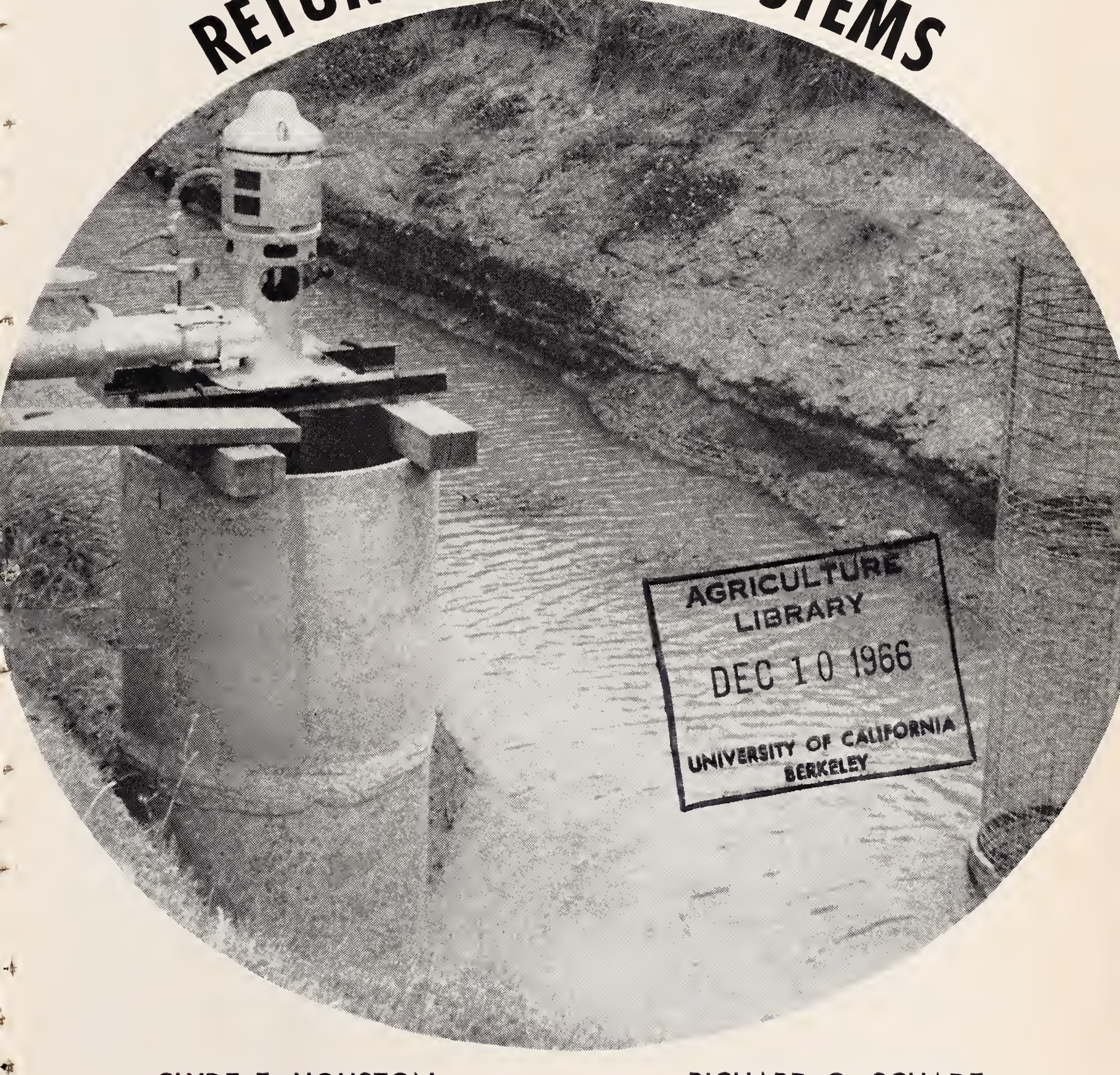
Division of Agricultural Sciences

UNIVERSITY OF CALIFORNIA

# IRRIGATION RETURN-WATER SYSTEMS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RICHARD O. SCHADE

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CIRCULAR 542

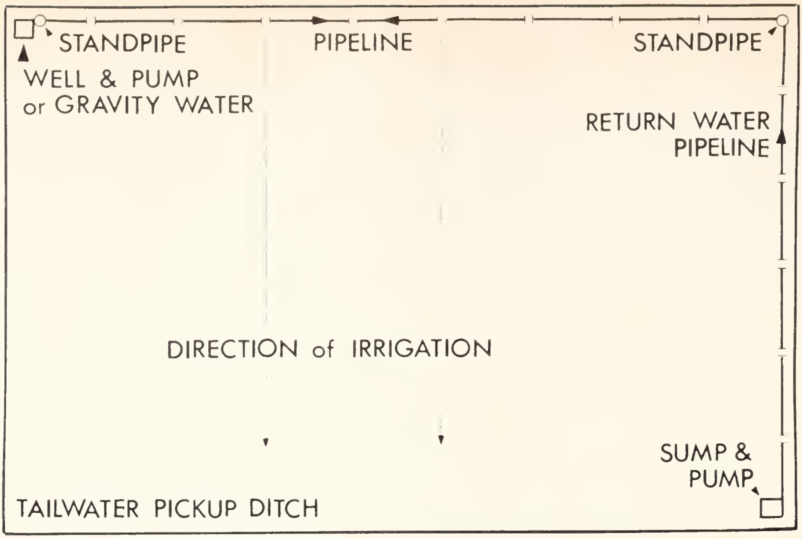


Diagram showing the ideal setup for an irrigation return water system.

An irrigation return-water system should be designed and installed by a competent engineer—it is too complex for the average "do it yourself" enthusiast.

This circular will not tell you how to build a system but it does discuss the things you should consider before you go to the expense of having one installed. For instance . . .

Is a system economically sound for your farm?

Will it alter your present ground water conditions and perhaps cause trouble?

How large a system should you have?

**THE AUTHORS:**

Clyde E. Houston is Extension Irrigation and Drainage Engineer, Davis; Richard O. Schade is Farm Advisor, Visalia.

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None of the surface irrigation methods currently being used permits absolute control of the water and the result is often a substantial loss to the operator. As much as 40 to 60 per cent of the water applied to a field may be lost to deep percolation and/or surface runoff. Deep percolation may be essential, in some soils, to maintain a favorable salt balance, but in others it is simply wasted.

Applying the water by sprinklers can decrease this loss but only a small percentage of the state's acreage uses this method.

Runoff loss can also be kept lower by the use of additional labor during irrigation but the grower must balance the cost of labor against the cost of water to determine whether this practice is economically sound.

Thus tailwater (excess water that collects at the lower end of a field) may be an economic necessity or it may be the consequence of the operation of a well-designed irrigation system. In many cases it is unavoidable. The question is what to do with it.

If allowed to remain on the field, it has the obvious disadvantages of fostering mosquitoes and the growth of water-loving weeds instead of a commercial crop.

It may be removed with surface or subsurface drains.

It may be collected and pumped to an outlet or back to the high end of the field and reused. The engineer designing an irrigation system must provide some satisfactory means of disposing of tailwater.

### Consideration of costs

Surveys indicate that the cost of power for pumping runoff water will range from \$1 to \$1.50 per acre foot. The annual fixed cost will range from \$1 to \$5 per acre foot, depending on the size of the system and the amount of pipe needed.

The average cost of the disposal

A large-diameter concrete pipe used for a sump is neat and does not remove valuable land from production—a consideration for intensive farming of high-income crops.

methods suggested have been found to range from 0 (where the water can be drained by gravity) to $5.50 per acre foot (where sump pump and pipe are required).

The cost and availability of water also enter into the consideration. If water is available in unlimited quantities, at no cost, it will probably be best to dispose of tailwater by gravity drain or a pump outlet.

If water costs are greater than the cost of removal and reuse; or if water is limited in quantity and valuable in terms of the production potential; or if the grower must pay a penalty for excess drainage water, he should probably reclaim it and reuse it. In much of California the cost and limited availability of water is making reuse of tailwater economically sound.

## Size of the system

All components of the system must have a capacity that will accommodate the maximum rate of tailwater flow. The designer will have to consider the influence of crop rotation and irrigation management and must estimate the maximum runoff rates from available data on soil intake rates and rates of flow into the irrigation system. If small sumps are to be used, these estimates must be fairly precise; for large sumps with large volume capacities, errors in estimate are not particularly critical.

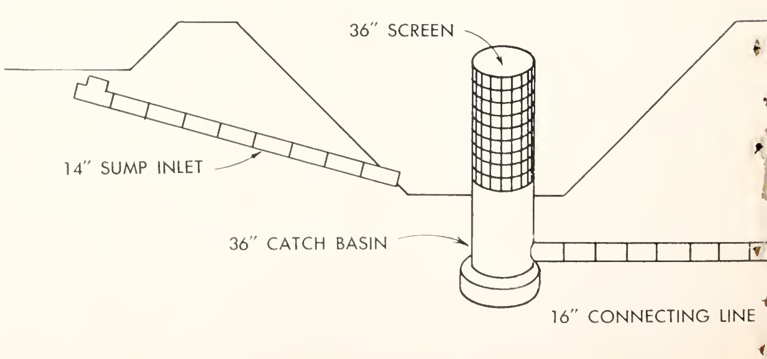
A "rule of thumb" derived from recent observations in the San Joaquin Valley suggest that a system should be able to handle 20 per cent of the water applied.

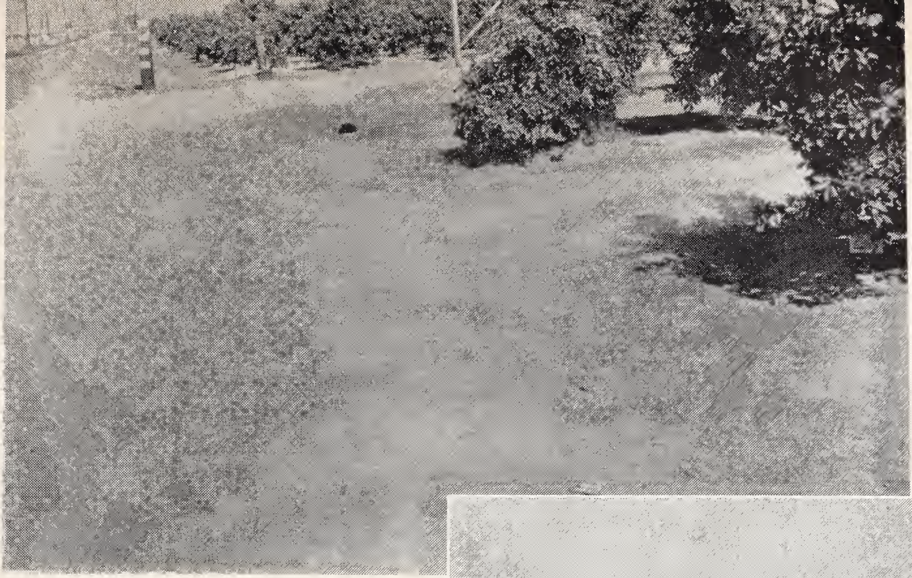
## Water quality and temperature

Surface flows from irrigated fields seldom pick up high salt concentrations and as a result runoff flows diminish very little in chemical quality.

The temperature of water flowing slowly or standing in sunshine will usually rise and this can affect weed growth, aquatic plants, and fish. The increased temperature of the irrigation water could, however, be beneficial for such crops as rice.

The drawing shows all of the elements needed in most return water systems. Their arrangement on any farm would depend on size, shape, and topography of the fields involved.

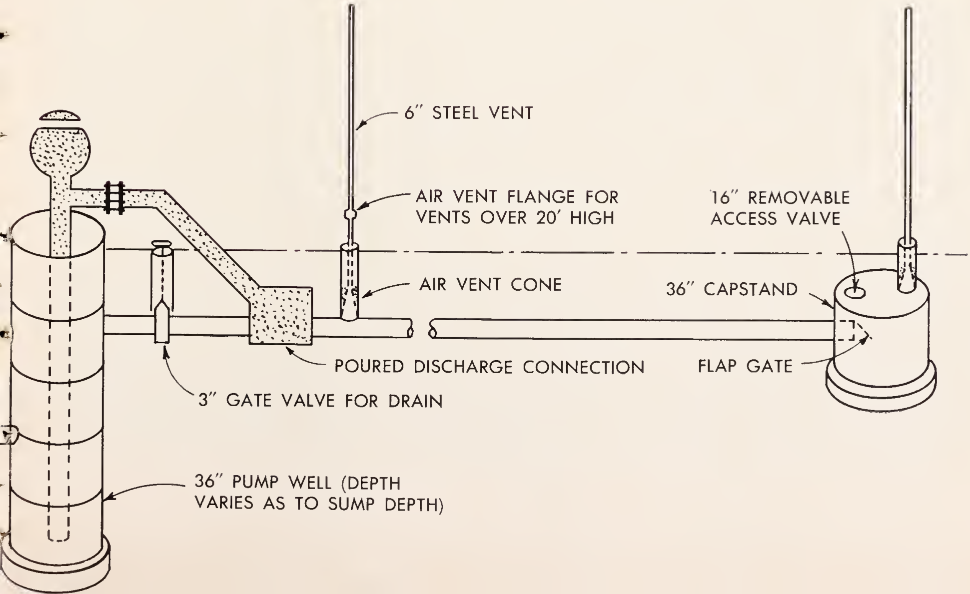




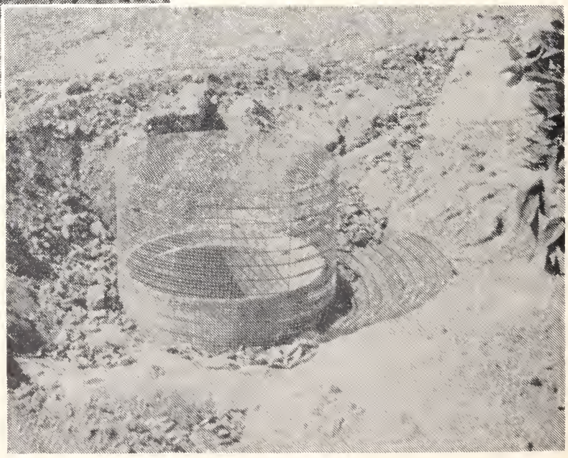
Tailwater may be collected at the end of the run and conveyed (above) through a shallow ditch or depression to a sump.

OR

The sump may extend along the entire length of a field and be used as a collection ditch as well as a sump.



When tailwater is allowed to flow through pipes (above) or directly into an open sump (left) at rates that cause erosion, sediment will collect and the sump must be cleaned periodically.



In any type of system, the sump entrance must be protected by a grating or wire to strain the water.

**How big** the sump should be and what type should be used will depend on the value of your land and what kind of control you want at the point to which the water is returned, that is, at the head of the irrigation system.

Where land is expensive and intensively cultivated (in an orchard, for instance) the sump should be as small as possible—probably one or more pieces of $4 \times 8'$ concrete pipe laid on end. For this type it is essential that all debris and silt be removed from the water before it flows into the sump.

Where land is plentiful (permanent pasture, for instance) a ditch-type sump may be called for. Such sumps should be at least five feet deep to discourage growth of tules, cattails, etc., and an access road around the sump is desirable for spraying and other maintenance chores. Unless all water can be pumped from the sump, the pump inlet or off level should allow for an unused storage depth of about one foot, and mosquito fish should be planted in the sump.

If the irrigation distribution system uses a regulating reservoir or a pipeline, a small sump with a rapidly cycling pump is satisfactory.

If a head ditch and siphons or small overflow structures are used, a large sump may be needed to insure a steady flow rate when the tailwater system is in operation.

**The pump.** Single stage, turbine-type pumps have been found adequate for most return-water systems. Horsepower requirements may vary from two to 10 depending on the size of the system.

For large sumps or excavated pits, the pump should be located to provide easy access for maintanance of both sump and pump. For small sumps, the pump is usually placed in the center of the sump and a separate inlet with screening and a sediment trap is arranged for in the plan.

Trash racks and desilting chambers must be provided between large, open sumps and the return-flow pump.

The desilting or debris-removal boxes may be placed next to the sump or (as shown above) at the end of the collection ditch.

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